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VPDES Permit Modification
Conceptual Engineer's Report

Comment [jac1]: Engineering?

Dominion Resources Services, Inc.
Coal Combustion By-Product Pond Closure Project
Possum Point Power Station
Prince William County, Virginia

GAI Project Number: C150132.00, Task 047

July 2015

Dominion

Prepared by: GAI Consultants, Inc.
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Prepared for: Dominion Resources Services, Inc.
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Glen Allen, Virginia 23060-3308

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1.0 Project Overview

1.1 Introduction

~~Dominion Resources Services, Inc.~~Virginia Electric and Power Company d/b/a Dominion (Dominion) is in the process of implementing a long-term strategy for its existing coal combustion by-product (CCB) (ash) ponds at Possum Point Power Station, an 1,845 megawatt natural gas and oil fired (previously coal-fired) steam electric generating station near Dumfries, Prince William County, Virginia (VA). ~~Since ash sluicing operations are no longer applicable to the facility, the strategy comprises closure plans for the ash ponds on site.~~

1.2 Project Description

Dominion is currently working to close five existing ash ponds at the Possum Point Power Station (Station) located in Dumfries, VA. The five ponds are designated A, B, C, D and E and their locations are shown on Drawing C150132.00 - Aerial Outfall Exhibit, Station Outfalls and Treatment Facilities. Ponds A, B, and C were originally three contiguous ponds that have been inactive since the 1960's. All five ponds are scheduled for closure by April 2018 in accordance with the Coal Combustion Residual (CCR) regulations provided in 40 Code of Federal Regulations (CFR), Part 257, Subpart D, dated April 17, 2015.

Ash Pond E has been decanted, dewatered, and is presently being dredged. The dredged ash materials and contact/pore waters are being relocated to Ash Pond D for storage. Ash Pond E can then be clean-closed and regraded ~~and closed~~. Ash Ponds A, B, and C are to be dewatered, ~~and~~ dredged and clean-closed. The dredged ash materials and contact/pore waters are also to be relocated to Ash Pond D for storage. Following transfer of the dredged ash materials and associated waters from A, B, C and E, Ash Pond D is to be decanted, and in situ and dredged ash materials are to be dewatered, regraded, capped, and closed. A single regulated solid waste facility for the station's ash will be maintained at closed Ash Pond D; the construction drawings, specifications, and permitting application package for this facility is under separate cover.

1.2.1 Purpose and Need

The process leading to closure of Ponds A, B, C, D, and E will involve management of the following water/wastewater types:

Comment [jac2]: What about "decant water"?

- ***Ash Dewatering Water*** from Ponds A, B, C, D and E. Dewatering Water refers to the water that is produced from the dewatering of the ash in order to stabilize the ash and allow for its removal by mechanical dredging (Ponds A, B, C, and E) or its grading for the construction of a cap system (Pond D). Dewatering Water is currently being generated onsite by the excavation of trenches to drain the ash and by the installation of wells that are being used to pump water out of the ash.
- ***Contact Water*** from Ponds A, B, C, D and E. Contact Water refers to stormwater that comes in contact with ash. Contact Water must be removed from the working areas to close the ponds.
- ***Outfall 501 Water*** from the Station's metal cleaning basins. Outfall 501 Water is a permitted internal outfall that was previously discharged into Pond E.
- ***Outfall 502 Water*** from the Station's oily water treatment basin. Outfall 502 Water is a permitted internal outfall that was previously discharged into Pond E.
- ***Pond D Comingled Water***, which refers to the above listed wastewaters that have accumulated or been pumped into Pond D. Pond D Comingled Water must be drained from Pond D to allow for the closure of Pond D. Pond D comingled water

includes approximately 74 million gallons of Contact Water (previously permitted for discharge through Pond E) that has accumulated in Pond D since its construction.

- ***Pond D Underdrainage***, which refers to subsurface waters draining the closed and capped Pond D soil/ash below the impermeable liner. These waters are expected to reduce over time and eventually stop flowing.

The purpose of this document is to identify the planned treatment, mixing/blending, and handling/discharge options for the above water/wastewaters. This document is intended to accompany the Station's Application for Permit Modification for their VirginiaA Department of Environmental Quality (~~Va~~DEQ) V~~A~~irginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0002071. The Permit Modification is required to address waters/wastewaters during construction and post construction (the configurations of the related flow paths are herein referred to as "Interim Configuration" and "Final Configuration", respectively).

1.2.2 Location and Description of Selected Project Facilities - Pre Construction

Selected facilities that are or are planned to be affected by the project are discussed. Locations and descriptions of the facilities are based on their respective pre-construction condition, or unless otherwise discussed. Refer to Drawing PP-0-SP-STA-600, Water Flow Balance Line Diagram, for the pre-construction configuration of the Station's facilities, flow streams, and outfalls as presently permitted.

1.2.2.1 Ash Ponds A, B, and C

Ash Ponds A, B, and C were actively utilized during the period from 1955 through the early 1960s. Subsequenlty, the ponds have been ~~filled in with ash and subsequently~~ reclaimed by natural vegetative cover. The drainage area containing the inactive ash ponds is associated with ~~the~~ a stormwater outfall (referred to as Outfall S104).

~~Ponds A, B, and C were originally constructed such that the natural drainage flowed from Pond A to Pond B to Pond C where the accumulated runoff was released to Quantico Creek through a discharge structure. Recent improvements to the natural drainage has resulted in potential for stormwater to come in contact with ash. Subsequently, in June 2014 Dominion applied for a VaDEQ VPDES Permit for Industrial Stormwater Discharges for Outfall S104.~~

Dominion plans to clean-close Ponds A, B, and C by relocating the ash to Pond D. During closure construction activities at Ponds A, B, and C, Dominion proposes to direct all Contact Water and Ash Dewatering Water from Ponds A, B, and C to Pond D.

1.2.2.2 Ash Pond D

Ash Pond D is the largest ash pond onsite and ~~was formerly used as~~was constructed to provide a location for final disposal of ~~the master~~ much of the ash produced by the station during the generation of electricity. ~~disposal pond.~~ Presently, a permanent pool of water is roughly maintained at 35-ft below the top of the dam. Ash Pond D presently accepts stormwater runoff from the surrounding watershed. The outfall is configured to discharge to Ash Pond E.

Dominion is presently utilizing Ash Pond D for storage of ash and Ash Dewatering Water~~,~~ Contact Water, Outfall 501 Water, and Outfall 502 Water. The combination of these waters is~~,~~ referred herein as "Pond D Comingled Water". ~~These stored waters are not able to be discharged directly to a permitted Outfall until a Permit Modification is obtained and treatment and/or mixing/blending facilities are in active operation, or as otherwise required.~~

Comment [KR3]: Is this still accurate?

Comment [KR4]: This sentence seems incomplete.

Comment [KR5]: I don't see a water balance called pre-constrution configuration. Is this the same as Interim?

Comment [jac6]: This seems too high. I believe that prior to dredging from Pond E, watrer was about 50 feet below the top of the dam.

1.2.2.3 Ash Pond E

Ash Pond E was historically the former day-to-day ash pond onsite. After ash operations ceased, it served as the final treatment system for the remainder of the various stormwater and process wastewaters. It discharges via a riser structure to permitted Outfall 005. Permitted Outfall 005 discharges to an unnamed tributary of Quantico Creek. Ash Pond E is permitted to accept, treat, and discharge the following wastewater streams from the power station:

- stormwater runoff;
- Oil Water Treatment Basin effluent from Internal Outfall 502;
- Metals Cleaning Waste Treatment Facility effluent from Internal Outfall 501;
- raw Potomac River water; and
- Pond D decanted water.

Ash Pond E has been decanted as of May 2015, prior to beginning dredging activities at Pond E. The decanted waters were discharged through Outfall 005 at the riser structure by removing stop logs. There have been no discharges from Pond E since the pond was decanted.

1.2.2.4 Metals Cleaning Waste Treatment Facility

The Metals Cleaning Waste Treatment Facility consists of two (2) lined ponds (referred to as the north and south ponds) in series that accept and treat ~~flush~~ wastewaters generated by the cleaning of the station's boiler and other metallic equipment. The treated effluent from the Metals Cleaning Waste Treatment Facility (i.e., Outfall 501 Water) was historically ~~is~~ discharged from ~~at~~ the south pond to Pond E. In addition to stormwater that contributes to the Metals Cleaning Waste Treatment Facility, the ponds are presently permitted to batch treat intermittent wastewater streams generated from cleaning/flushing operations at the following facilities:

- boiler;
- preheater;
- economizer;
- precipitator; and
- associated piping.

The source of the cleaning/flush waters is raw, untreated river water from the Potomac River. ~~Operations at the Metals Cleaning Waste Treatment Facility are as follows:~~

- ~~Metals cleaning wastewater is trucked to the north pond until it fills in approximately three to four days.~~
- ~~The wastewater is allowed to settle approximately two months.~~
- ~~A discharge valve is opened to the south pond.~~
- ~~Dry lime is dumped into the south pond and a trickle of coagulant, GE Betz Klaraid is applied.~~
- ~~The wastewater is allowed to treat/settle approximately two more months.~~
- ~~After treatment, the Metals Cleaning Waste Treatment Facility effluent is discharged to Pond E at approximately 1.04 million gallons per day (mgd) during an approximately three-day period.~~
- ~~South pond is pumped free of sludge with "vac" trucks every two or three years.~~

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The wastewaters in the Metals Cleaning Waste Treatment Facility have been treated in 2015 and discharged to decanted Ash Pond E for collection. This operation was performed prior to

dredging operations at Ash Pond E. These Outfall 501 Waters were subsequently pumped to Ash Pond D for storage. Dominion does not anticipate discharging wastewater out of the Metals Cleaning Waste Treatment Facility in the immediate future.

1.2.2.5 Oil Water Treatment Basin

The Oil Water Treatment Basin is an open pond north of the oil storage tanks and containment areas along the Potomac River. The effluent from the Oil Water Treatment Basin (Internal Outfall 502) was historically ~~is~~ pumped via Lift Station No. 4 or No. 5 to Pond E. In addition to stormwater that contributes to the Oil Water Treatment Basin, the ponds are presently permitted to batch treat wastewater from the following facilities:

- Unit 5 seal oil system;
- low head circulation water filter;
- Unit 5 floor drains;
- Unit 5 boiler blowdown;
- Unit 5 "hotwell" blowdown;
- Unit 5 flash tank drain;
- Unit 5 evaporator blowdown;
- Unit 5 flash evaporator condensate dump;
- Unit 5 tank drains;
- auxiliary boiler blowdown;
- Unit 6 cooling tower drift; and
- turbine "false start" drains.

In addition to being routed to Ash Pond E through Outfall 502 the Oil Water Treatment Basin effluent (Internal Outfall 502) has ~~been historically~~on several occasions ~~allowed to~~ been temporarily diverted to the Low Volume Waste Settling Ponds and ultimately Outfall 004 with approval from DEQ. ~~on a temporary basis. Such temporary operations required an advanced notice to the VaDEQ and a 60-day window to temporarily divert the treated oil water.~~ Dominion has requested, through a Notice of Planned Changes, DEQ concurrence that a similar rerouting may be performed under the station's existing VPDES permit and we are seeking to make this a permanent configuration via this application for permit modification.

~~During decant operations at Pond E, the treated oil water from Internal Outfall 502 is to be pumped to Pond D for temporary storage. The wastewaters are to be handled at a later date before being discharged to Outfall 005 as presently permitted.~~

1.2.2.6 Potomac River Water

The present permit conditions allow for the use of raw, untreated Potomac River Water to be pumped to Ash Pond E to control pH and other constituents. The associated pump and piping systems were formerly for bottom ash sluicing operations.

1.2.2.7 Low Volume Waste Settling Ponds

The Low Volume Waste Settling Ponds consist~~s~~ of multiple cells with berms and overflows. The effluent from the Low Volume Waste Settling Ponds is discharged throughe Outfall 004 to the Potomac River. In addition to stormwater and yard drainage that contributes to the Low Volume Waste Settling Ponds, the ponds are presently permitted to treat and discharge the wastewater streams generated from the following facilities:

- Units 5 and 6 cooling tower drift;

- sand filter backwash;
- "quench" water;
- boiler blowdown;
- water treatment sumps/drains;
- turbine washwater;
- "false start" drains;
- reverse osmosis and "e-cell" blowdown;
- demineralized water;
- clarifier drains;
- neutralization pi;,
- low volume wastewater;
- Units 1, 2, 3, and 4 floor drains;
- Unit 4 distilled water;
- condenser drains and floor drains; and
- "EDR" blowdown.

Oil Water Treatment Basin effluent (Internal Outfall 502) has been permitted in the past to be diverted to the Low Volume Waste Settling Ponds and ultimately Outfall 004 on a temporary basis. ~~Such temporary operations required an advanced notice to the VaDEQ and a 60-day window to temporarily divert the treated oil water.~~ Through this application addendum Dominion is seeking to make this a permanent routing configuration.

1.3 Schedule During Construction/Closure Activities

The station is presently permitted under VPDES permit No. VA0002071 to discharge wastewaters from Ponds D and E through Outfall 005 to an unnamed tributary of Quantico Creek. However, at present there is currently no discharge from Outfall 005. All flows that were previously collected in Pond E are now being collected and stored in Pond D. Additionally, Pond D is being utilized to collect Ash Dewatering Water and Contact Water from Ponds A, B, C, and E. There is currently no discharge from Pond D. Refer to Drawing C150132-00-047-00-P-A2-001, Existing Conditions.

Ash Ponds A, B, C, and E will be clean-closed through the removal of ash in the ponds. To accomplish this, ash is presently being mechanically dredged from Pond E to Pond D. These operations began on June 15, 2015. Ash from Pond E is being stockpiled in the upper/northern portion of Pond D and is physically separated from the free water in Pond D. Ash from Ponds A, B, and C is scheduled to be mechanically dredged to Pond D beginning August 2015.

Ash Pond D will be closed as an inactive CCR surface impoundment by leaving the CCR in place and constructing a cap over the ash surface in accordance with 40 CFR §257.100.b.1. The ash in Pond D will be dewatered, ~~is be~~ stabilized and ~~,~~ graded. ~~fFill~~ will then be placed on the ash surface to create a slope that will drain ~~,~~ and produce a suitable platform on which to construct a geosynthetic and soil cap ~~over the ash surface~~ to limit infiltration into the ash.

In order to close the ponds as inactive surface impoundments in accordance with the new CCR regulations (40 CFR §257.100), ~~the CCR regulations require that~~ the surface impoundments must be closed no later than April 17, 2018. Dominion has developed the schedule provided in Table 1 to close the ponds as inactive facilities.

2.0 Interim Configuration

During the active construction phase (i.e., "Interim Configuration") of the pond closures project, the following water and wastewaters apply:

- Outfall 502 Water;
- Pond D Comingled Water;
- Ash Dewatering and Contact Waters; and
- Outfall 501 Water.

The water and wastewaters flow streams and discharge points are presented schematically on Drawing C150132-00-047-00-P-A2-002, Interim Configuration, and are further described in the following sections.

2.1 Outfall 502 Water

As part of the closure process, Dominion plans to divert the Oil Water Treatment Basin (Outfall 502 Water) to the Station's existing Low Volume Settling Ponds (Outfall 004). The proposed Oil Water diversion will facilitate the Station's closure of the Ash Ponds in accordance with our schedule. Temporary routing of Oil Water Treatment Basin to the Low Volume Settling Ponds (Outfall 004) has been permitted in the past by the ~~Va~~DEQ on an interim basis, and Dominion has requested permission to make this same rerouting under the existing permit via a Notice of Planned Changes submitted to DEQ on .

Both Outfall 502 and Outfall 004 are currently permitted as a low volume wastewater under the existing Steam Electric Effluent Guidelines (40 CFR Part 423) and the characteristics of the two waters are similar. To demonstrate this similarity, an analysis of the water quality from the Oil Water Treatment Basin was performed and the results are tabulated in Table 2. (~~Note the raw data is included in the Laboratory Sample Test Results provided in Appendix A and sample locations are provided in Drawing C150132.00, Sample Locations, Water Sampling Location Map.)~~ Table 2 also includes, for comparison purposes, the water quality data for Outfall 004 as reported in our 2013 Permit Reissuance Application, and a projected presumed quality of the combined discharge. The projected presumed quality of the combined discharge is estimated using the following mass balance calculations, as applicable:

Comment [KR7]: We are not planning to include the raw data with the Bremo submittal and I don't think that we need to provide it with this submittal. Also, we do not need to include the locations for sampling of the two samples collected from within the low volume waste ponds. We are not going to include those data with this submittal.

$$Combined\ Discharge\ Concentration = \left[\frac{mg}{L}\right] = \frac{Q_{004} \times Concentration_{004} + Q_{502} \times Concentration_{502}}{Q_{004} + Q_{502}}$$

Where

Q_{004} = Long term average flow[1] at Outfall 004 = 2.02-MGD

Q_{502} = 30-day maximum flow[2] at Outfall 502 = 0.567-MGD

$Concentration_{004}$ = Reported concentration[1] at Outfall 004 = $\left[\frac{mg}{L}\right]$

$Concentration_{502}$ = Measured concentration[2] at Outfall 502 = $\left[\frac{mg}{L}\right]$

---

1 Per 2013 VPDES Permit Reissuance Application.

2 Per test results on May 7, 2015 sample at Oil Water Treatment Basin.

$$Combined\ Discharge\ pH = [S.U.] = -\log\left(\frac{Q_{004} \times 10^{-pH_{004}} + Q_{502} \times 10^{-pH_{502}}}{Q_{004} + Q_{502}}\right)$$

Where

pH_{004} = Reported pH[1] at Outfall 004 = $[S.U.]$

pH_{502} = Measured pH[2] at Outfall 502 = $[S.U.]$

The combined discharge concentration formula above takes into account the constituent level as well as the volumetric flow rate of each of the discharges, respectively, i.e., Outfall 502 and Outfall 004 waters as a weighted average. The combined pH concentration formula above similarly takes into account the pH as well as the volumetric flow rate of each of the discharges, respectively, as a weighted average. Please note that the latter equation is an estimation that does not consider the complexities of other factors in the discharges such as alkalinity, hardness, etc. that may provide additional buffering capacity, i.e., resistance to changes in pH. These analyses demonstrate that the combined wastewater characteristics are consistent with that permitted for Outfall 004 under the existing permit.

2.2 Pond D Comingled Water

During the Interim Configuration Phase of the pond closure project, Pond D receives and stores Ash and Ash Dewatering Water and Contact Water from Ponds A, B, C, and E, as well as Outfall 501 Water. Pond D has recently received Outfall 502 Water, as well. These comingled waters will be given time to blend and allow for settling of suspended particles. In order to allow for closure of Pond D it will be necessary to first remove the accumulated ~~The~~ Pond D Comingled Water, which will be decanted and ultimately discharged through Outfall 005. Prior to discharge through Outfall 005, Pond D Comingled Water may be transferred, with pre-treatment to remove solids, to the clean-closed Pond E for storage. Following storage in Pond E and/or prior to direct discharge through Outfall 005, Pond D Comingled Water will receive further polishing/treatment as required to ensure compliance with Virginia surface water quality criteria in the receiveing stream and ~~meet the~~ VPDES discharge limits for Outfall 005. This decanting process will precede final dewatering and closure of Ash in Pond D. Refer to Table 3 for a comparison of the Outfall 005 data reported in the Station's 2013 Permit Reissuance Application and the measured quality of Ash Pond D Comingled Water. ~~(Note the raw data is included in the Laboratory Sample Test Results provided in Appendix A and sample locations are provided in Drawing C150132.00, Sample Locations, Water Sampling Location Map.)~~

Comment [KR8]: Same comment as above. We can provide the lab reports and more detail about the sample locations if requested.

An optional Interim Configuration for the Pond D Comingled Water is also considered and includes pretreatment (where required) and discharge to the Prince William County Service Authority (PWCSA) sanitary sewer collection system on Possum Point Road. This option is being evaluated separately with the PWCSA.

2.3 Ash Dewatering and Contact Waters

During pond closure activities and dredging of Ash Ponds A, B, C, and E, Ash Dewatering Water, as well as Contact Water will be collected and pumped to Pond D. Stormwater runoff will be diverted around the construction site to limit production of Contact Water. After closure of Ponds A, B, C, and E are completed, the areas will have been completely reclaimed, and stormwater will be non-contact and allowed to flow naturally overland.

During pond closure activities ~~and dredging~~ of Ash Pond D, Ash Dewatering Water, as well as Contact Water, will ~~need to~~ be collected, treated as necessary to ensure compliance with Virginia water quality standards and permit limits, and ~~pumped to~~ subsequently discharged to one or more of the following locations: Outfall 001/002 (via the Seal Pit), Outfall 004, or Outfall 005. Dominion is also evaluating the possibitility of taking the water to the PWCSA sanitary sewer collection system. Prior to discharge,

Comment [jac9]: We're not dredging Ash Pond D.

the water would be treated as necessary to ensure compliance with Virginia's water quality standards and VPDES permit limits.

~~.~~ Stormwater runoff will ~~also~~ be diverted around the construction site to limit production of Contact Water. After closure of Pond D is completed, the ash will have been completely capped, and stormwater will be non-contact and allowed to flow naturally overland.

Waters from Ponds A, B, C, D, and E during active construction include:

- stormwater exposed to ash (i.e., Contact Water);
- subsurface dewatering via constructed groundwater wells (i.e., Dewatering Water); and
- open pit~~s~~ or trenches in exposed ash material that collect~~s~~ surface and subsurface drainage (i.e., Dewatering Water).

Refer to Table 4 for a comparison of the Outfall 005 data reported in the Station's 2013 Permit Reissuance Application and the projected presumed quality of the blended Ash Dewatering Water and Contact Water. (Note the raw quality data is based on Ash Dewatering Water and Contact Water from Ash Pond E~~) and is included in the Laboratory Sample Test Results provided in Appendix A and sample locations are provided in Drawing C150132.00, Sample Locations, Water Sampling Location Map.)~~ The formulas presented in Section 2.1 are similarly used to project the presumed weighted average of the Ash Dewatering and Contact Waters. The weighted flows are based on a total of the Ash Dewatering Water rates of 333 gallons per minute (gpm) at Pond D and 203 gpm at Ponds A, B, and C, as well as Contact Water rates of 70 gpm at Pond D and 11 gpm Ponds A, B, and C. (Note the calculations for estimating the presumed Ash Dewatering and Contact Water rates are provided in Table 5.)

~~Optional configurations/discharge points for the Ponds A, B, C, and D Ash Dewatering and Contact Waters have been evaluated and include:~~

- ~~Low Volume Settling Ponds (Outfall 004);~~
- ~~Outfall 001/002; and~~
- ~~PWCSA sanitary sewer collection system.~~

For optional discharge to Outfall 004, the projected presumed quality of the blended Ash Dewatering Waters, Contact Waters, Low Volume Settling Ponds (Outfall 004), and Outfall 502 Water is provided in Table 6. For optional discharge to Outfall 001/002, the projected presumed quality of the blended Ash Dewatering Waters, Contact Waters, and Outfall 001/002 Water is included in Table 6. ~~For~~ The optional discharge to the PWCSA sanitary sewer collection system~~, pre-treatment may be required and~~ is being evaluated separately with the PWCSA.

Comment [KR10]: Where did these data come from and why don't we have the full suite of parameters?

2.4 Outfall 501 Water

As presented in the existing conditions section, the metals cleaning wastewater discharge will continue to be routed through Pond D for additional polishing and settling, as needed, until such time the Pond D is dewatered for closure. At that time the metal washing discharge may receive interim polishing/treatment, as required, to ensure compliance with Virginia surface water quality standards and ~~meet the established~~ VPDES discharge limits for Outfall 005 ~~(Note the raw quality data is included in the Laboratory Sample Test Results provided in Appendix A and sample locations are provided in Drawing C150132.00, Sample Locations, Water Sampling Location Map.).~~

3.0 Final Configuration

During the post construction phase (i.e., "Final Configuration") of the pond closures project, the following water and wastewaters apply:

- Outfall 502 Water;
- Pond D Passive Underdrainage; and
- Outfall 501 Water.

The water and wastewaters flow streams and discharge points are presented schematically on Drawing C150132-00-047-00-P-A2-003, Final Configuration, and are further described in the following sections.

3.1 Outfall 502 Water

Post construction, the Oil Water Treatment Basin effluent (i.e., Outfall 502 Water) will continue to be routed through the Low Volume Waste Ponds and discharged at Outfall 004 as described in Section 2.1 above.

3.2 Pond D Passive Underdrainage

During the closing and capping of Pond D, a subsurface dewatering system (i.e., underdrains) will be installed to remove excess water below the impermeable liner of Pond D. This residual water will be pumped to a treatment system with Outfall 501 Water, and, if required, will be further processed/ treated, as required, to ensure compliance with Virginia surface water quality standards and ~~meet the~~ VPDES discharge limits.

An optional Final Configuration for the Pond D Passive Underdrainage is also considered and includes pretreatment (where required) and discharge to the PWCSA sanitary sewer collection system on Possum Point Road. This option is being evaluated separately with the PWCSA.

3.3 Outfall 501 Water

The existing Metals Cleaning Waste Treatment Facility effluent (i.e., Outfall 501 Water) will be discharged to a treatment system with Pond D Passive Underdrainage, and, if required, will be further processed/treated, as required, to ensure compliance with Virginia surface water quality standards and~~meet the~~ VPDES discharge limits.

An optional Final Configuration for the Pond D Passive Underdrainage is also considered and includes pretreatment (where required) and discharge to the PWCSA sanitary sewer collection system on Possum Point Road. This option is being evaluated separately with the PWCSA.

4.0 Conceptual Treatment Options

4.1 Conceptual Treatment Requirements

Potential treatment options to be utilized (if required) to ensure compliance with Virginia surface water standards and ~~meet~~ VDPES permit discharge limits may include, but are not limited to:

- chemical additives;
- sedimentation;
- filtration;
- ion exchange/absorption; and/or
- packed bed biofilters.

4.1.1 Chemical Additives

Chemical additives can reduce the solubility of metals, and may include, but are not limited to, hydrated lime, sodium hydroxide, iron salts, and alum. Chemical additives can react with the dissolved metal directly to reduce its solubility, or indirectly by changing the solubility equilibrium.

Certain insoluble metal compounds do not have sufficient ionic attraction to provide adequate sedimentation. The use of chemical additives is typically required to neutralize the charges of the metal compound complexes and facilitate agglomeration into flocs. The weight of the floc allows for more efficient settling. Hydrated lime, iron salts, alum, and polymers are often utilized to facilitate floc agglomeration.

Chemical additives can also prepare collected sludge for dewatering.

Refer to Table 8 for a listing of potential commercial chemical additives that may be utilized.

4.1.2 Sedimentation

Upon inducing chemical precipitation of dissolved constituents, and for constituents already out of solution, the targeted metals and TSS needs to be physically removed from the wastewater. This can be accomplished by sedimentation/clarification and/or filtration. Sedimentation utilizes a tank or clarifier to allow treated water to flow to the top and be discharged while the targeted metal particles settle to the bottom by gravity. Sludge accumulates in the bottom of the tank or clarifier, and when it collects to a sufficient quantity, it can be removed and disposed. The use of a mechanical filter press or drying bed reduces the liquid content of the sludge to facilitate disposal.

4.1.3 Filtration

Bag and cartridge filters generally have nominal or absolute TSS capture ratings based on particle size and require changeout and disposal of the spent bags and cartridges. Bag and cartridge filters are housed in pressurized vessels.

Media filters require periodic backwashing to keep media from "blinding" as well as preventing "breakthrough." Media can include silica sand, and for multimedia filters an additional top coarse layer of anthracite and/or a bottom fine layer garnet sand may be added. Media filters may be pressurized or function by gravity (via upflow filters or traditional gravity filters).

4.1.4 Ion Exchange

For certain dissolved metals (depending on oxidation state), removal from wastewater cannot be obtained by conventional water treatment technology, but are better facilitated with treatment options such ion exchange and adsorption systems. Both passive and active/pressurized ion exchange media systems are available and use various resins or other media technologies. The media in passive systems is disposed of and replaced when spent. Active systems utilize a regeneration step that retains the media for continued use. Ion exchange technologies can be expected to require pre-treatment of TSS.

4.1.5 Packed Bed Biofilters

Packed bed biofilters are a type of plug flow bioreactor that relies on a specialized mixture of microbes that thrive in an anaerobic environment. The microbes may be attached to activated carbon or silica sand media. The microbes digest/reduce target contaminants or convert their soluble forms to insoluble forms for removal. Periodic backwashing of the media is typically

required; although required backwashes are infrequent unless necessitated by high TSS loadings. Packed bed biofilter technologies can be expected to require pre-treatment of TSS.

4.2 Mixing and Blending Systems

Mixing and blending can be provided in an existing or proposed basin or in a manufactured tank. In some cases, smaller flows may be mixed/blended by injection directly into the larger flow stream, especially when it is equipped with an in line static mixer. Mixing and blending systems are useful when combining much poorer quality waters with better quality waters; i.e., to provide a suitable quality for discharge that would otherwise be unacceptable for one or more of the flow streams and to provide some buffering for upsets. Manufactured tanks can be permanent or portable. Generally, manufactured tanks will hold less volume than an existing or proposed basin. Additional weirs, dynamic mixers, or static mixers may be suggested to further facilitate blending.

5.0 Recommendations

GAI anticipates that a treatment system for "Interim Configuration," i.e., the Ash Dewatering, Contact Waters, Outfall 501 Water and potentially the Pond D Comingled Waters, could consist of one or a combination of the following technologies:

- a clarifier with chemical additives for initial TSS/precipitated metals treatment, and/or
- a bag, cartridge, or media filter system for additional TSS/precipitated metals treatment, and
- polishing of dissolved heavy metals, if necessary, may be provided by either the ion exchange or packed bed biofilter systems.

~~The recommended treatment system for the "Interim Configuration" is only in anticipation of effluent limitations that may be enforced by the VaDEQ for discharging to Outfall 005.~~

~~It is presumed that the optional discharge of the above "Interim Configuration" waters to Outfall 001/002 and Outfall 004 would meet effluent limitations by dilution and/or blending/mixing, respectively. Another optional "Interim Configuration" for the above waters includes pretreatment (where required) and discharge to the PWCSA sanitary sewer collection system.~~

Comment [KR11]: I would not include this section because it provides speculation on potential requirements.

For the "Final Configuration," a treatment system is minimally anticipated for the Outfall 501 Water and the Pond D Passive Underdrainage prior to discharge to Outfall 005. An optional "Final Configuration" for the Outfall 501 Water and Pond D Passive Underdrainage is also considered and includes pretreatment (where required) and discharge to the PWCSA sanitary sewer collection system. Furthermore, it is presumed that the "Interim Configuration" and "Final Configuration" routing of Outfall 502 Water to the Low Volume Settling Ponds (Outfall 004) would be acceptable since the quality of waters are similar.

TABLES

Table 1

Proposed Ponds A, B, C, D, and E Closure Schedule and Proposed Wastewater Average Flow Rates

No.	Activity	Approximate Start Date	Approximate End Date	Proposed Average Flow Rate (mgd)	Proposed Volume (mg)
1	Mechanically Dredge Ash from Pond E into Pond D	06/015	10/2015	-	-
2	Mechanically Dredge Ash from Ponds A, B, and C into Pond D	07/2015	10/2015	-	-
3[1]	**Decant Pond D Comingled Water to begin Drying Pond D**	**08/2015**	**09/2015**	**2.53**	**74±**
4	Temporarily discharge Outfall 502 Water to Low Volume Settling Ponds and Outfall 004 (pending Notice of Plan Change to VaDEQ)	08/2015	03/2016	-	-
5	Grade Ash in North Half of Pond D to Establish Subgrade	11/2015	03/2016	-	-
6	**Discharge Ash Dewatering Water and Contact Water**	**01/2016**	**06/2017[2]**	**0.72**	**107±**
7	**Discharge Outfall 501 Water**	**01/2016**	**Not Applicable**	**1.04**	**3± (over 3 days per event)**
8	**Discharge Outfall 502 Water to Low Volume Settling Ponds and Outfall 004 (pending VPDES permit modification)**	**01/2016**	**Not Applicable**	**0.57**	**-**
9	Ponds A, B, C, and E Soil Amendments and Seeding; Construct Temporary Sediment Basins in Ponds A, B, C, and E for Discharge of Stormwater (pending County Site Plan and VSMP Permit)	03/2016	03/2017	-	-
10	Grade Ash and Import Fill from Borrow to Establish Subgrade (entire Pond D)	03/2016	08/2016	-	-
11	Construct Pond D Cap (geosynthetic liner and two feet of cover soil)	08/2016	06/2017	-	-
12	**Closed Ash Pond D Passive Underdrain[3]**	**06/2017**	**12/2018**	**0.15**	**68±**
13	Construct Storm Water Controls/Channel Linings	07/2017	08/2017	-	-
14	Pond D Soil Amendments and Seeding	09/2017	10/2017	-	-
15	CCR Regulations Closure Deadline For Inactive Surface Impoundments	04/17/2018	04/17/2018	-	-

Notes:

1 Bold text denotes wastewater flows/activities.

2 According to this schedule, Contact Water will no longer be generated after June 2017, when the Pond D cap will be complete. Dewatering Water may continue to be produced after capping of Pond D as needed to aid in the dewatering and stabilization.

3 Estimated duration of flow for passive underdrain system is 18 months.

DRAWINGS

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APPENDIX A
Laboratory Sample Test Results

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